AMENDMENTS TO THE CLAIMS

1. (currently amended) An apparatus for acquiring seismic data used in characterizing a subsurface formation, comprising:

a) a sensor unit coupled to an earth's surface for sensing seismic energy, the sensor unit sensing seismic energy imparted into the subsurface formation and providing a signal indicative of seismic energy reflected from the subsurface formation and suitable for imaging the subsurface formation;

b) an acquisition device co-located with the sensor unit and coupled thereto for receiving the signal;

c) a location sensor associated with the acquisition device and residing in ~~providing a location parameter to only~~ the acquisition device~~, the location parameter being processed with the acquired seismic data~~;

d) a memory unit having a first memory disposed in the acquisition device for storing in digital form information indicative of the received signal;

e) a second memory for storing a location parameter associated with the sensor unit; and

f) a communication device for providing direct wireless bi-directional communication between the acquisition device and a remotely-located central controller.

[need to clarify in the provisional application the use of the on-board GPS]
[to get around Tanenhaus, we'll need to add discussion regarding known distance between the source and the receiver]

2. (currently amended) An apparatus according to claim 1, wherein the sensor unit, the location sensor and the acquisition device are co-located, and wherein the location sensor and the acquisition device are in a common housing and the sensor unit is in a sensor housing separate from the common housing.

3. (currently amended) An apparatus according to claim 1, wherein the sensor unit is in a first housing and the acquisition device is in a second housing separate from the first housing, and the first housing and the second housing are coupled together with a cable.

4. (original) An apparatus according to claim 1, wherein the sensor unit includes one of a velocity sensor and a pressure sensor.

5. (original) An apparatus according to claim 1, wherein the sensor unit includes an accelerometer.

6. (original) An apparatus according to claim 1, wherein the sensor unit further comprises a multi-component sensor.

7. (original) An apparatus according to claim 1, wherein the sensor unit further comprises a multi-component accelerometer having a digital output signal.

8. (original) An apparatus according to claim 1 further comprising an analog-to-digital converter disposed in the sensor unit, the signal provided by the sensor unit including a digital signal.

9. (original) An apparatus according to claim 1, wherein the signal is an analog signal, the apparatus further comprising an analog-to-digital converter disposed in the acquisition device for converting the signal to digital data.

10. (original) An apparatus according to claim 1, wherein the first memory further comprises a nonvolatile memory.

11. (original) An apparatus according to claim 1, wherein the first memory further comprises a removable memory.

12. (original) An apparatus according to claim 1, wherein the first memory further comprises one or more of a miniature hard disk drive and a nonvolatile removable memory card.

13. (original) An apparatus according to claim 1, wherein the memory unit includes an inductive coupling device for transferring the information stored in the memory unit to an external device.

14. (original) An apparatus according to claim 1, wherein the memory unit includes an optical coupling device for transferring the information stored in the memory unit to an external device.

15. (original) An apparatus according to claim 1, wherein the sensor unit is coupled to the acquisition device using a sensor connector, the memory unit also being coupled to the sensor connector for enabling retrieval of the information stored in the memory unit using the sensor connector.

16. (currently amended) An apparatus according to claim 1, wherein communication with the remotely-located central controller provides wireless command and control for the apparatus, the remotely-located central controller being programmed to control seismic data acquisition for imaging a subsurface formation.

17. (original) An apparatus according to claim 1 further comprising a processor associated with the acquisition unit and the communication device, the processor processing programmed instructions enabling a software-defined radio transceiver.

18. (original) An apparatus according to claim 1, wherein the communication device includes a direct conversion radio transceiver for wireless communication between the apparatus and the remotely-located central controller.

19. (original) An apparatus according to claim 1 further comprising a processor in the acquisition unit for providing one or more of local control, time keeping, and power management.

20. (original) An apparatus according to claim 1 further comprising a power source disposed in the acquisition device for providing electrical power to one or more of the acquisition device, the sensor unit and the communication device.

21. (original) An apparatus according to claim 20, wherein the power source is removable.

22. (original) An apparatus according to claim 20, wherein the power source includes a rechargeable battery.

23. (original) An apparatus according to claim 22 further comprising an inductive coupling in the acquisition device, the inductive coupling being operably coupled to the rechargeable battery to allow charging of the rechargeable battery by a second power source external to the acquisition device.

24. (original) An apparatus according to claim 22 further comprising a connector disposed in the data acquisition device, the connector being operably coupled to the rechargeable battery to allow charging of the rechargeable battery by a second power source external to the acquisition device.

25. (original) An apparatus according to claim 22, wherein the rechargeable battery comprises one or more of a nickel-metal hydride battery, a lithium-ion battery, and a lithium-polymer battery.

26. (currently amended) An apparatus according to claim 1, wherein the location sensor ~~comprising~~ comprises a GPS receiver for determining the location parameter.

Claims 27-60 are cancelled.

61. (currently amended) A system for seismic surveying to characterize a subsurface formation, comprising:

a) a central controller;

b) an array for acquiring seismic data relating to a subsurface formation and being controlled by the central controller; the array including at least one acquisition device comprising:

(i) a sensor unit remotely located from the central controller, the sensor unit coupled to the earth for sensing seismic energy in the earth and for providing a signal indicative of the seismic energy reflected from the subsurface formation;

~~c)~~ (ii) a recorder device co-located with the sensor unit and coupled thereto for receiving the signal and for storing in digital form information indicative of the received signal in a first memory disposed in the recorder device;

(iii) an acquisition device processor in communication with the sensor unit and the recorder device;

~~d)~~ (iv) a location sensor communicating with only the processor, wherein the processor ~~co-located with the recorder device providing a location parameter~~, the sensor unit, the recorder device and the location sensor ~~forming~~ form a single sensor station~~, the location parameter being correlated with the acquired seismic data to generate a image of the subsurface formation~~;

~~g)~~ (v) a second memory for storing a location parameter associated with the sensor unit; and

~~g)~~ (vi) a communication device co-located with the sensor unit and the recorder device for providing direct wireless bi-directional communication with the central controller.

62. (original) A system according to claim 61 further comprising an energy source for providing the seismic energy in the earth.

63. (original) A system according to claim 61, wherein the communication device includes a two-way wireless transceiver for wireless communication with the central controller.

Claims 64-68 are cancelled.

69. (currently amended) A system for seismic data acquisition comprising:

a) a central controller;

b) a plurality of sensors disposed to form a seismic spread having a plurality of sensing locations, the seismic spread being proximate to a subsurface formation of interest and generating signals indicative of the sensed seismic energy;

c) a separate recorder co-located with each sensor recording and storing seismic information corresponding to a selected sensing location from the plurality of sensing locations, ~~each recorder being in direct bi-directional communication with the central controller~~;

d) a separate processor co-located with each sensor, each processor being in direct wireless bi-directional communication with the central controller; and

d) a location sensor associated with each recorder providing a location parameter, the location parameter being correlated with the acquired seismic data to image the subsurface formation.

70. (currently amended) An apparatus for seismic imaging of a subsurface formation, comprising:

a) a plurality of sensors disposed to form a seismic spread having a plurality of sensing locations, the seismic spread being positioned proximate to a subsurface formation of interest to sense seismic energy imparted into the subsurface formation and generate responsive signals;

b) a plurality of recorders, each of the plurality of recorders co-located with one sensor and recording and storing in digital form seismic information corresponding to a selected sensing location from the plurality of sensing locations, the seismic information being in a form for seismic imaging of the subsurface formation; and

c) a location sensor associated with each of the plurality of recorders providing a location parameter to be correlated with the acquired seismic data.

71. (currently amended) An apparatus for seismic data acquisition comprising:

a) ~~a~~ one sensor unit for sensing seismic energy, the one sensor unit providing a signal indicative of the sensed seismic energy, the one sensor unit being positioned over a subsurface formation of interest to sense seismic energy imparted into the subsurface formation and generate signals indicative of the seismic energy sensed from one selected location;

b) a location sensor ~~co-located with the sensor unit~~ providing a location parameter for the one sensor unit ~~to be correlated with the acquired seismic data~~.

c) an acquisition device co-located with the sensor unit and ~~coupled~~ receiving seismic signals from only the one sensor unit ~~thereto~~ for receiving the signal and the location parameter;

d) a memory unit disposed in the acquisition device for storing information indicative of the received signal and storing the location parameter for only the sensor unit; and

e) a direct-conversion radio transceiver for providing communication between the acquisition device and a remotely-located central controller.

72. (new) The apparatus according to claim 1 wherein the acquisition unit is configured to receive the location parameter entered by a field crew.

73. (new) The apparatus according to claim 72 further comprising a GPS receiver, wherein the field crew uses the GPS to determine the location parameter.

74. (new) The apparatus according to claim 72 wherein the location parameter is a longitude and a latitude of the sensor unit.

75. (new) The apparatus according to claim 74 wherein the location parameter for the sensor unit further includes one of (i) an azimuth and (ii) an inclination.

76. (new) The apparatus according to claim 61 wherein the central controller receives a system parameter relating to the apparatus, the system parameter being an adjusted location parameter.

77. (new) The apparatus according to claim 76 wherein the adjusted location parameter is relative to a predetermined location spread.

78. (new) The apparatus according to claim 61 further comprising at least a seismic data processor programmed to process the location parameter with the acquired seismic data.

79. (new) The apparatus according to claim 61 further comprising at least a characterization processor programmed to characterize the subsurface formation using the acquired seismic data.